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# Parallel Problem Solving from Nature – PPSN X

10th International Conference  
Dortmund, Germany, September 13-17, 2008  
Proceedings

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# Preface

The first major gathering of people interested in discussing natural paradigms and their application to solve real-world problems in Europe took place at Dortmund, Germany, in 1990. What was planned originally as a small workshop with about 30 participants finally grew into an international conference named Parallel Problem Solving from Nature (PPSN) with more than 100 participants. The interest in the topics of the conference has increased steadily ever since leading to the pleasant necessity of organizing PPSN conferences biennially within the European region. After visiting Brussels (1992), Jerusalem (1994), Berlin (1996), Amsterdam (1998), Paris (2000), Granada (2002), Birmingham (2004), and Reykjavik (2006), PPSN returned to its birthplace in Dortmund to celebrate its 10th anniversary in 2008.

Without any doubt the PPSN conference series evolved to be one of the most respected and highly regarded conferences on natural computing. Therefore we are very pleased to present the proceedings of the 10th International Conference on Parallel Problem Solving from Nature (PPSN X) to the scientific community. This year we received 206 submissions with authors from 26 countries spread over Africa, America, Asia, Australia and Europe. From these submissions the Program Chairs selected the top 114 papers after an extensive peer-review process. Not all decisions were easy to make but in all cases we benefited greatly from the careful reviews provided by the international Program Committee. We requested four reviews for each submission leading to a total of 824 requests for reviews. Thanks to these reviews we were able to decide about acceptance on a solid basis.

The papers included in these proceedings have been assigned to six fuzzy clusters (formal theory, new techniques, experimental analysis, multiobjective optimization, hybrid methods, and applications) that can hardly reflect the true variety of research topics presented in the proceedings at hand. Following the tradition and spirit of PPSN, all papers were presented as posters. The 8 poster sessions consisting of about 14 papers each were compiled orthogonally to the fuzzy clusters mentioned above to cover the range of topics as widely as possible. As a consequence, participants with different interests would find some relevant papers in every session and poster presenters were able to discuss related work in sessions different to their own. As usual, the conference also included one day with workshops (Saturday), one day with tutorials (Sunday), and three invited plenary talks (Monday to Wednesday) for free.

Needless to say, the success of such a conference depends on authors, reviewers, and organizers. We are grateful to all authors for submitting their best and latest work, to all the reviewers for the generous way they spent their time and provided their valuable expertise in preparing these reviews, to the workshop organizers and tutorial presenters for their valorizing contributions to the conference event, and to the local organizers who helped to make PPSN X happen.

Last but not least, we would like to thank the Collaborative Research Center ‘Computational Intelligence’ (SFB 531) at the Dortmund University of Technology and the Deutsche Forschungsgemeinschaft (DFG) for financial support as well as the Gesellschaft für Informatik (GI) for administrative support in international monetary transactions.

July 2008

Günter Rudolph  
Thomas Jansen  
Simon Lucas  
Carlo Poloni  
Nicola Beume

# Organization

PPSN X was organized and hosted by the Computational Intelligence Group of the Lehrstuhl für Algorithm Engineering, Fakultät für Informatik, Technische Universität Dortmund (TU Dortmund), Germany. The conference took place in the Kongresszentrum Westfalenhallen, Dortmund.

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# Table of Contents

## Formal Theory

On the Behaviour of the (1+1)-ES for a Simple Constrained Problem . . . <i>Dirk V. Arnold and Daniel Brauer</i>	1
$\sigma$ -Self-Adaptive Weighted Multirecombination Evolution Strategy with Scaled Weights on the Noisy Sphere . . . . . <i>Hans-Georg Beyer and Alexander Melkozerov</i>	11
Convergence Analysis of Evolution Strategies with Random Numbers of Offspring . . . . . <i>Olivier François</i>	21
Multiobjectivization by Decomposition of Scalar Cost Functions . . . . . <i>Julia Handl, Simon C. Lovell, and Joshua Knowles</i>	31
A Blend of Markov-Chain and Drift Analysis . . . . . <i>Jens Jägersküpper</i>	41
On Multiplicative Noise Models for Stochastic Search . . . . . <i>Mohamed Jebalia and Anne Auger</i>	52
Premature Convergence in Constrained Continuous Search Spaces . . . . . <i>Oliver Kramer</i>	62
Approximating Minimum Multicuts by Evolutionary Multi-objective Algorithms . . . . . <i>Frank Neumann and Joachim Reichel</i>	72
Simplified Drift Analysis for Proving Lower Bounds in Evolutionary Computation . . . . . <i>Pietro S. Oliveto and Carsten Witt</i>	82
Ignoble Trails – Where Crossover Is Provably Harmful . . . . . <i>J. Neal Richter, Alden Wright, and John Paxton</i>	92
Lower Bounds for Evolution Strategies Using VC-Dimension . . . . . <i>Olivier Teytaud and Hervé Fournier</i>	102
Rigorous Runtime Analysis of Inversely Fitness Proportional Mutation Rates . . . . . <i>Christine Zarges</i>	112

**New Techniques**

Covariance Matrix Adaptation Revisited – The CMSA Evolution Strategy .....	123
<i>Hans-Georg Beyer and Bernhard Sendhoff</i>	
Enhancing the Performance of Maximum – Likelihood Gaussian EDAs Using Anticipated Mean Shift .....	133
<i>Peter A.N. Bosman, Jörn Grahl, and Dirk Thierens</i>	
New Approaches to Coevolutionary Worst-Case Optimization.....	144
<i>Jürgen Branke and Johanna Rosenbusch</i>	
Bio-inspired Search and Distributed Memory Formation on Power-Law Networks .....	154
<i>Tathagata Das, Subrata Nandi, Andreas Deutsch, and Niloy Ganguly</i>	
Enhancing the Efficiency of the ECGA .....	165
<i>Thyago S.P.C. Duque, David E. Goldberg, and Kumara Sastry</i>	
Extreme Value Based Adaptive Operator Selection .....	175
<i>Álvaro Fialho, Luís Da Costa, Marc Schoenauer, and Michèle Sebag</i>	
Uncertainty Handling in Model Selection for Support Vector Machines .....	185
<i>Tobias Glasmachers and Christian Igel</i>	
Niche Radius Adaptation with Asymmetric Sharing .....	195
<i>Vincent van der Goes, Ofer M. Shir, and Thomas Bäck</i>	
Adaptive Encoding: How to Render Search Coordinate System Invariant .....	205
<i>Nikolaus Hansen</i>	
Supervised and Evolutionary Learning of Echo State Networks.....	215
<i>Fei Jiang, Hugues Berry, and Marc Schoenauer</i>	
Dynamic Cooperative Coevolutionary Sensor Deployment Via Localized Fitness Evaluation .....	225
<i>Xingyan Jiang, Yuanzhu Peter Chen, and Tina Yu</i>	
On the Run-Time Dynamics of a Peer-to-Peer Evolutionary Algorithm.....	236
<i>Juan L.J. Laredo, Agoston E. Eiben, Maarten van Steen, and Juan J. Merelo</i>	
Mixed-Integer Evolution Strategies with Dynamic Niching.....	246
<i>Rui Li, Jeroen Eggermont, Ofer M. Shir, Michael T.M. Emmerich, Thomas Bäck, Jouke Dijkstra, and Johan H.C. Reiber</i>	

A Compass to Guide Genetic Algorithms . . . . .	256
<i>Jorge Maturana and Frédéric Saubion</i>	
Testing the Intermediate Disturbance Hypothesis: Effect of Asynchronous Population Incorporation on Multi-Deme Evolutionary Algorithms . . . . .	266
<i>Juan J. Merelo, Antonio M. Mora, Pedro A. Castillo, Juan L.J. Laredo, Lourdes Araujo, Ken C. Sharman, Anna I. Esparcia-Alcázar, Eva Alfaro-Cid, and Carlos Cotta</i>	
A Developmental Approach to the Uncapacitated Examination Timetabling Problem . . . . .	276
<i>Nelishia Pillay and Wolfgang Banzhaf</i>	
QFCS: A Fuzzy LCS in Continuous Multi-step Environments with Continuous Vector Actions . . . . .	286
<i>José Ramírez-Ruiz, Manuel Valenzuela-Rendón, and Hugo Terashima-Marín</i>	
A Simple Modification in CMA-ES Achieving Linear Time and Space Complexity . . . . .	296
<i>Raymond Ros and Nikolaus Hansen</i>	
Evolutionary Algorithms for Dynamic Environments: Prediction Using Linear Regression and Markov Chains . . . . .	306
<i>Anabela Simões and Ernesto Costa</i>	
Combination of Natural and Numerical Optimization Methods at the Example of an Internal Gas Turbine Cooling Channel . . . . .	316
<i>Helga Steinbrück, Sebastian Zehner, Bernhard Weigand, and Sven Olaf Neumann</i>	
When Does Quasi-random Work? . . . . .	325
<i>Olivier Teytaud</i>	
Fitness Expectation Maximization . . . . .	337
<i>Daan Wierstra, Tom Schaul, Jan Peters, and Jürgen Schmidhuber</i>	
<b>Experimental Analysis</b>	
Formally Testing Liveness by Means of Compression Rates . . . . .	347
<i>César Andrés, Ismael Rodríguez, and Fernando Rubio</i>	
How a Generative Encoding Fares as Problem-Regularity Decreases . . . .	358
<i>Jeff Clune, Charles Ofria, and Robert T. Pennock</i>	
Sub-tree Swapping Crossover, Allele Diffusion and GP Convergence . . . .	368
<i>Stephen Dignum and Riccardo Poli</i>	

How Single Ant ACO Systems Optimize Pseudo-Boolean Functions . . . .	378
<i>Benjamin Doerr, Daniel Johannsen, and Ching Hoo Tang</i>	
Actuation Constraints and Artificial Physics Control . . . . .	389
<i>Chris Ellis and R. Paul Wiegand</i>	
Genetic Repair for Optimization under Constraints Inspired by <i>Arabidopsis Thaliana</i> . . . . .	399
<i>Amy FitzGerald and Diarmuid P. O'Donoghue</i>	
Improved Multilabel Classification with Neural Networks . . . . .	409
<i>Rafał Grodzicki, Jacek Mańdziuk, and Lipo Wang</i>	
Enhancing Efficiency of Hierarchical BOA Via Distance-Based Model Restrictions . . . . .	417
<i>Mark Hauschild and Martin Pelikan</i>	
Evolution Strategies for Direct Policy Search . . . . .	428
<i>Verena Heidrich-Meisner and Christian Igel</i>	
Optimal Nesting of Species for Exact Cover: Many against Many . . . . .	438
<i>Jeffrey Horn</i>	
Nonsynonymous to Synonymous Substitution Ratio $k_a/k_s$ : Measurement for Rate of Evolution in Evolutionary Computation . . . . .	448
<i>Ting Hu and Wolfgang Banzhaf</i>	
Examining the Effect of Elitism in Cellular Genetic Algorithms Using Two Neighborhood Structures . . . . .	458
<i>Hisao Ishibuchi, Noritaka Tsukamoto, and Yusuke Nojima</i>	
The Generalisation Ability of a Selection Architecture for Genetic Programming . . . . .	468
<i>David Jackson</i>	
Reinforcement Learning: Insights from Interesting Failures in Parameter Selection . . . . .	478
<i>Wolfgang Konen and Thomas Bartz-Beielstein</i>	
Evolvable Agents in Static and Dynamic Optimization Problems . . . . .	488
<i>Juan L.J. Laredo, Pedro A. Castillo, Antonio M. Mora, Juan J. Merelo, Agostinho Rosa, and Carlos Fernandes</i>	
The Impact of Global Structure on Search . . . . .	498
<i>Monte Lunacek, Darrell Whitley, and Andrew Sutton</i>	
Improved Lower Limits for Pheromone Trails in Ant Colony Optimization . . . . .	508
<i>David C. Matthews</i>	

Evolving Neural Networks for Online Reinforcement Learning . . . . .	518
<i>Jan Hendrik Metzen, Mark Edgington, Yohannes Kassahun, and Frank Kirchner</i>	
Costs and Benefits of Tuning Parameters of Evolutionary Algorithms . . .	528
<i>Volker Nannen, Selmar Kagiso Smit, and Agoston E. Eiben</i>	
Cooperation in Co-evolving Networks: The Prisoner's Dilemma and Stag-Hunt Games . . . . .	539
<i>Enea Pestelacci and Marco Tomassini</i>	
Preventing Premature Convergence in a Simple EDA Via Global Step Size Setting . . . . .	549
<i>Petr Pošík</i>	
A Steady-State Genetic Algorithm with Resampling for Noisy Inventory Control . . . . .	559
<i>Steven Prestwich, S. Armagan Tarim, Roberto Rossi, and Brahim Hnich</i>	
EA-Powered Basin Number Estimation by Means of Preservation and Exploration . . . . .	569
<i>Catalin Stoean, Mike Preuss, Ruxandra Stoean, and Dumitru Dumitrescu</i>	
Coevolving Cellular Automata with Memory for Chemical Computing: Boolean Logic Gates in the BZ Reaction . . . . .	579
<i>Christopher Stone, Rita Toth, Ben de Lacy Costello, Larry Bull, and Andrew Adamatzky</i>	
The Influence of Mutation on Protein-Ligand Docking Optimization: A Locality Analysis . . . . .	589
<i>Jorge Tavares, Alexandru-Adrian Tantar, Nouredine Melab, and El-Ghazali Talbi</i>	
Testing the CAX on a Real-World Problem and Other Benchmarks . . . .	599
<i>Ariel Tchougang, Alexandre Blansch�e, Laurent Baumes, Nicolas Lachiche, and Pierre Collet</i>	
Countering Poisonous Inputs with Memetic Neuroevolution . . . . .	610
<i>Julian Togelius, Tom Schaul, J�rgen Schmidhuber, and Faustino Gomez</i>	
Parameter Control Methods for Selection Operators in Genetic Algorithms . . . . .	620
<i>P�ter Vajda, Agoston E. Eiben, and Wiebe Hordijk</i>	
Evaluation and Diversity in Co-evolution . . . . .	631
<i>Rients P.T. van Wijngaarden and Edwin D. de Jong</i>	

Comparison of Adaptive Approaches for Differential Evolution . . . . . 641  
*Karin Zielinski, Xinwei Wang, and Rainer Laur*

**Multiobjective Optimization**

Analyzing Hypervolume Indicator Based Algorithms . . . . . 651  
*Dimo Brockhoff, Tobias Friedrich, and Frank Neumann*

Solving Three-Objective Optimization Problems Using a New Hybrid Cellular Genetic Algorithm . . . . . 661  
*Juan José Durillo, Antonio Jesús Nebro, Francisco Luna, and Enrique Alba*

Runtime Analyses for Using Fairness in Evolutionary Multi-Objective Optimization . . . . . 671  
*Tobias Friedrich, Christian Horoba, and Frank Neumann*

The Parallel Predator-Prey Model: A Step towards Practical Application . . . . . 681  
*Christian Grimme, Joachim Lepping, and Alexander Papaspyrou*

Functional-Specialization Multi-Objective Real-Coded Genetic Algorithm: FS-MOGA . . . . . 691  
*Naoki Hamada, Jun Sakuma, Shigenobu Kobayashi, and Isao Ono*

Investigations into the Effect of Multiobjectivization in Protein Structure Prediction . . . . . 702  
*Julia Handl, Simon C. Lovell, and Joshua Knowles*

On the Use of Projected Gradients for Constrained Multiobjective Optimization Problems . . . . . 712  
*Alfredo G. Hernandez-Diaz, Carlos A. Coello Coello, Luis V. Santana-Quintero, Fatima Perez, Julian Molina, and Rafael Caballero*

Diversity Maintenance Mechanism for Multi-Objective Genetic Algorithms Using Clustering and Network Inversion . . . . . 722  
*Tomoyuki Hiroyasu, Kenji Kobayashi, Masashi Nishioka, and Mitsunori Miki*

Many Objective Optimisation: Direct Objective Boundary Identification . . . . . 733  
*Evan J. Hughes*

Use of Heuristic Local Search for Single-Objective Optimization in Multiobjective Memetic Algorithms . . . . . 743  
*Hisao Ishibuchi, Yasuhiro Hitotsuyanagi, Noritaka Tsukamoto, and Yusuke Nojima*

Distance Based Ranking in Many-Objective Particle Swarm Optimization . . . . .	753
<i>Sanaz Mostaghim and Hartmut Schmeck</i>	
A Study of Convergence Speed in Multi-objective Metaheuristics . . . . .	763
<i>Antonio Jesús Nebro, Juan José Durillo, Carlos A. Coello Coello, Francisco Luna, and Enrique Alba</i>	
Team Algorithms Based on Ant Colony Optimization – A New Multi-Objective Optimization Approach . . . . .	773
<i>Christian Lezcano, Diego Pinto, and Benjamín Barán</i>	
Multiobjective Optimization on a Limited Budget of Evaluations Using Model-Assisted $\mathcal{S}$ -Metric Selection . . . . .	784
<i>Wolfgang Ponweiser, Tobias Wagner, Dirk Biermann, and Markus Vincze</i>	
Approximating the Knee of an MOP with Stochastic Search Algorithms . . . . .	795
<i>Oliver Schütze, Marco Laumanns, and Carlos A. Coello Coello</i>	
Approximate Solutions in Space Mission Design . . . . .	805
<i>Oliver Schütze, Massimiliano Vasile, and Carlos A. Coello Coello</i>	
A Local Search Based Evolutionary Multi-objective Optimization Approach for Fast and Accurate Convergence . . . . .	815
<i>Karthik Sindhya, Kalyanmoy Deb, and Kaisa Miettinen</i>	
A Convergence Criterion for Multiobjective Evolutionary Algorithms Based on Systematic Statistical Testing . . . . .	825
<i>Heike Trautmann, Uwe Ligges, Jörn Mehnert, and Mike Preuss</i>	
A Proposal to Hybridize Multi-Objective Evolutionary Algorithms with Non-gradient Mathematical Programming Techniques . . . . .	837
<i>Saúl Zapotecas Martínez and Carlos A. Coello Coello</i>	
SPAM: Set Preference Algorithm for Multiobjective Optimization . . . . .	847
<i>Eckart Zitzler, Lothar Thiele, and Johannes Bader</i>	
<b>Hybrid Methods</b>	
Modeling Human Expertise on a Cheese Ripening Industrial Process Using GP . . . . .	859
<i>Olivier Barrière, Evelyne Lutton, Cedric Baudrit, Mariette Sicard, Bruno Pinaud, and Nathalie Perrot</i>	
Readable and Accurate Rulesets with ORGA . . . . .	869
<i>Md Nor Ridzuan Daud and David Corne</i>	



A Distributed Memetic Algorithm for the Routing and Wavelength Assignment Problem . . . . .	879
<i>Thomas Fischer, Kerstin Bauer, and Peter Merz</i>	
Theoretical Analysis of Initial Particle Swarm Behavior . . . . .	889
<i>Sabine Helwig and Rolf Wanka</i>	
Large-Scale Optimization of Non-separable Building-Block Problems . . .	899
<i>David Iclănzan and Dumitru Dumitrescu</i>	
Particle Filter with Swarm Move for Optimization . . . . .	909
<i>Chunlin Ji, Yangyang Zhang, Mengmeng Tong, and Shengxiang Yang</i>	
A Feasibility-Preserving Crossover and Mutation Operator for Constrained Combinatorial Problems . . . . .	919
<i>Martin Lukaszewycz, Michael Glaß, and Jürgen Teich</i>	
An Iterated Local Search Approach for Finding Provably Good Solutions for Very Large TSP Instances . . . . .	929
<i>Peter Merz and Jutta Huhse</i>	
Intrinsic System Model of the Genetic Algorithm with $\alpha$ -Selection . . . . .	940
<i>André Neubauer</i>	
Imitation Learning in Uncertain Environments . . . . .	950
<i>Steffen Priesterjahn and Markus Eberling</i>	
Using Ants' Task Division for Better Game Engines – A Contribution to Game Accessibility for Impaired Players . . . . .	961
<i>Alexis Sepchat, Romain Clair, Nicolas Monmarché, and Mohamed Slimane</i>	
A Set-Based Particle Swarm Optimization Method . . . . .	971
<i>Christian B. Veenhuis</i>	
<b>Applications</b>	
Nature-Inspired Synthesis of Rational Protocols . . . . .	981
<i>Almudena Alcaide, Juan M.E. Tapiador, Julio C. Hernandez-Castro, and Arturo Ribagorda</i>	
Optimizing Real-Time Ordered-Data Broadcasts in Pervasive Environments Using Evolution Strategy . . . . .	991
<i>Rinku Dewri, Darrell Whitley, Indrajit Ray, and Indrakshi Ray</i>	
A Multiobjective Evolutionary Algorithm for the Linear Shelf Space Allocation Problem . . . . .	1001
<i>Anna I. Esparcia-Alcázar, Ana I. Martínez-García, Jose M. Albarracín-Guillem, Marta E. Palmer-Gato, Juan J. Merelo, Ken C. Sharman, and Eva Alfaro-Cid</i>	

A Memetic Algorithm for the Delineation of Local Labour Markets . . . . .	1011
<i>Francisco Flórez-Revueita, José Manuel Casado-Díaz, Lucas Martínez-Bernabeu, and Raúl Gómez-Hernández</i>	
Evolving XSLT Stylesheets for Document Transformation . . . . .	1021
<i>Pablo Garcia-Sanchez, Juan J. Merelo, Juan L.J. Laredo, Antonio Mora, and Pedro A. Castillo</i>	
Fast Multi-objective Scheduling of Jobs to Constrained Resources Using a Hybrid Evolutionary Algorithm . . . . .	1031
<i>Wilfried Jakob, Alexander Quinte, Karl-Uwe Stucky, and Wolfgang Süß</i>	
Virus Evolution Strategy for Vehicle Routing Problems with Time Windows . . . . .	1041
<i>Hitoshi Kanoh and Souichi Tsukahara</i>	
Learning Fuzzy Rules with Evolutionary Algorithms—An Analytic Approach . . . . .	1051
<i>Jens Kroeske, Adam Ghandar, Zbigniew Michalewicz, and Frank Neumann</i>	
Evolving Regular Expressions for GeneChip Probe Performance Prediction . . . . .	1061
<i>William B. Langdon and Andrew P. Harrison</i>	
Evolutionary Market Agents for Resource Allocation in Decentralised Systems . . . . .	1071
<i>Peter R. Lewis, Paul Marrow, and Xin Yao</i>	
GA-Net: A Genetic Algorithm for Community Detection in Social Networks . . . . .	1081
<i>Clara Pizzuti</i>	
Learning Walking Patterns for Kinematically Complex Robots Using Evolution Strategies . . . . .	1091
<i>Malte Römmermann, Mark Edgington, Jan Hendrik Metzen, Jose de Gea, Yohannes Kassahun, and Frank Kirchner</i>	
Driving Cars by Means of Genetic Algorithms . . . . .	1101
<i>Yago Saez, Diego Perez, Oscar Sanjuan, and Pedro Isasi</i>	
AGE-P: A Platform for Open Evolution . . . . .	1111
<i>Ralf Salomon and Stefan Goldmann</i>	
Adding Probabilistic Dependencies to the Search of Protein Side Chain Configurations Using EDAs . . . . .	1120
<i>Roberto Santana, Pedro Larrañaga, and Jose A. Lozano</i>	

A Scalable Formal Framework for Analyzing the Behavior of Nature-Inspired Routing Protocols . . . . .	1130
<i>Muhammad Shahzad, Saira Zahid, and Muddassar Farooq</i>	
A Grouping Genetic Algorithm Using Linear Linkage Encoding for Bin Packing . . . . .	1140
<i>Özgür Ülker, Emin Erkan Korkmaz, and Ender Özcan</i>	
Optimization of Feature Processing Chain in Music Classification by Evolution Strategies . . . . .	1150
<i>Igor Vatulkin and Wolfgang Theimer</i>	
<b>Author Index</b> . . . . .	1161

# On the Behaviour of the (1+1)-ES for a Simple Constrained Problem

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**Abstract.** This paper studies the behaviour of the (1 + 1)-ES when applied to a linear problem with a single linear constraint. It goes beyond previous work by considering constraint planes that do not contain the gradient direction. The behaviour of the distance of the search point from the constraint plane forms a Markov chain. The limit distribution of that chain is approximated using an exponential model, and progress rates and success probabilities are derived. Consequences for the working of step length adaptation mechanisms based on success probabilities are discussed.

## 1 Introduction

Constraint handling is an important aspect of numerical optimisation. See [6, 7, 10, 11, 14] and the references therein for examples of constraint handling techniques that have been proposed in connection with evolution strategies. The performance of new techniques is commonly evaluated using large and diverse sets of test functions, such as the benchmark set compiled for the *CEC 2006 Special Session on Constrained Real-Parameter Optimization* [8]. Moreover, the evaluation criteria used are relatively complex and involve various parameters, such as the number of function evaluations allowed and different quality thresholds. As a result, the observed outcomes are not always easy to interpret.

In contrast, in the realm of unconstrained optimisation there is a significant body of work employing simple test functions that aims at arriving at a better understanding of the behaviour of evolution strategies. See [1, 2, 5, 13] for examples and further references. Starting from the simplest non-trivial strategies and optimisation environments, the complexity of the scenarios studied has increased over time, and today results are available for adaptive strategies and problems with various degrees of ill-conditioning. The approach complements observations for large and difficult test beds with results that are easy to interpret, and that reveal scaling properties and the influence of parameters on optimisation performance.

The *Handbook of Evolutionary Computation* [3, page B2.4:11f] lists a small number of studies that use simple test functions and derive analytical results in the realm of constrained optimisation with evolution strategies. Rechenberg [12]